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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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on
Lake Travis
Burnet and Travis Counties
Texas
EPA Region VI
Working Paper No. 664

With the cooperation of the
Texas Water Quality Board
and the
Texas National Guard
April, 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating point-source discharge reduction and non-point source pollution control in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Texas Water Quality Board for professional involvement, to the Texas National Guard for conducting the tributary sampling phase of the Survey, and to those Texas wastewater treatment plant operators who voluntarily provided effluent samples.

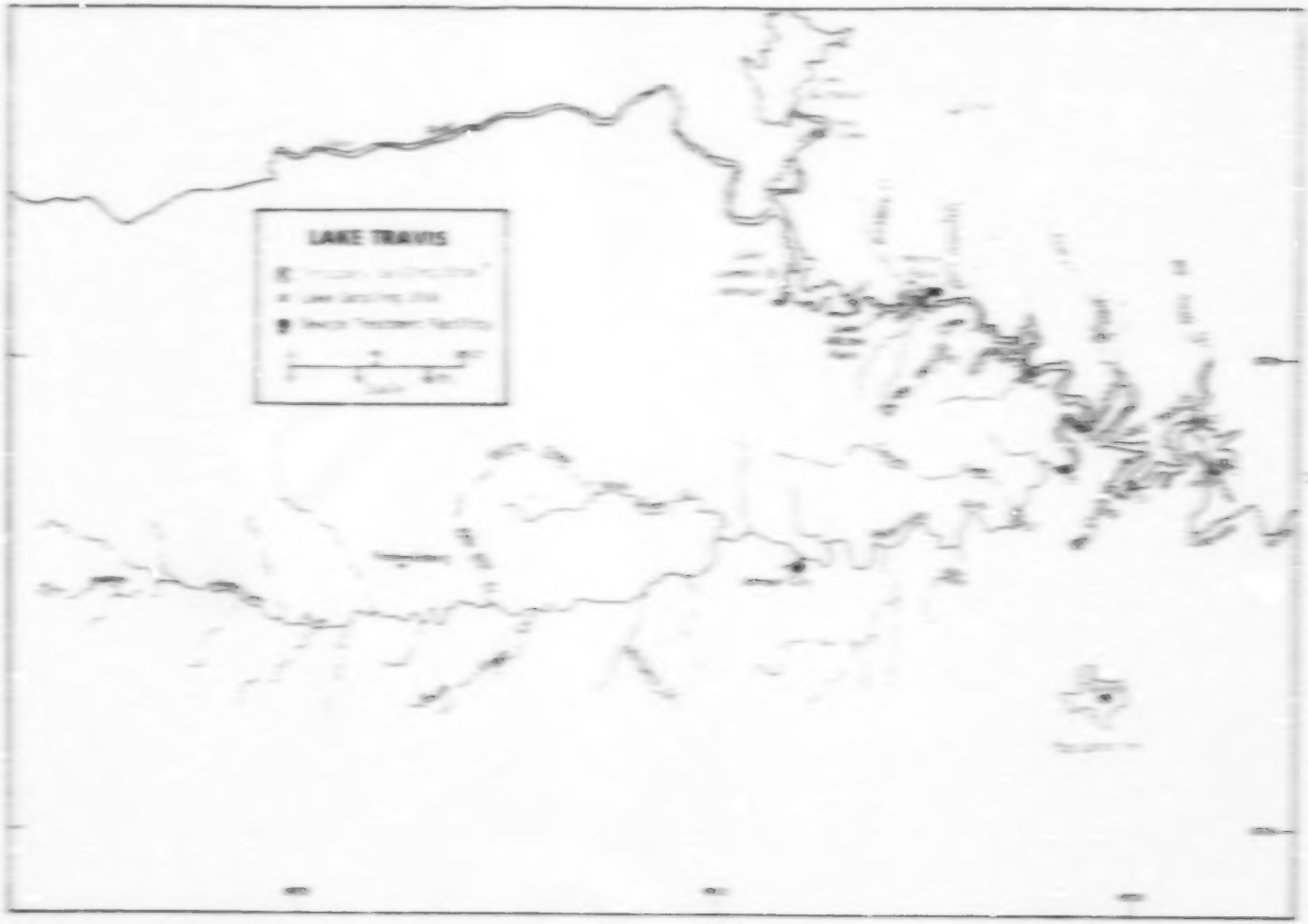
Hugh C. Yantis, Jr., Executive Director of the Texas Water Quality Board, and John B. Latchford, Jr., Director, and the staff of the Field Operations Division provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

Major General Thomas Bishop, the Adjutant General of Texas, and Project Officer Colonel William L. Seals, who directed the volunteer efforts of the Texas National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY
STUDY RESERVOIRS
State of Texas

NAME	COUNTY
Amistad	Val Verde
Bastrop	Bastrop
Belton	Bell, Coryell
Braunig	Bexar
Brownwood	Brown
Buchanan	Burnet, Llano
Caddo	Harrison, Marion, TX; Caddo Parish, LA
Calaveras	Bexar
Canyon	Comal
Colorado City	Mitchell
Corpus Christi	Jim Wells, Live Oak, San Patricio
Diversion	Archer, Baylor
Eagle Mountain	Tarrant, Wise
Fort Phantom Hill	Jones
Houston	Harris
Kemp	Baylor
Lake O'The Pines	Camp, Marion, Morris, Upshur
Lavon	Collin
Lewisville (Garza-Little Elm)	Denton
Livingston	Polk, San Jacinto, Trinity, Walker

Lyndon B. Johnson	Burnet, Llano
Medina	Bandera, Medina
Meredith	Hutchinson, Moore, Potter
O. C. Fisher (San Angelo)	Tom Green
Palestine	Anderson, Cherokee, Henderson, Smith
Possum Kingdom	Palo Pinto, Stephens, Young
Sam Rayburn	Angelina, Jasper Nacogdoches, Sabine, San Augustine
Somervville	Burleson, Lee, Washington
E. V. Spence	Coke
Stamford	Haskell
Stillhouse Hollow	Bell
Tawakoni	Hunt, Rains, Van Zandt
Texoma	Cooke, Grayson TX; Bryan, Johnston, Love, Marshall, OK
Travis	Burnet, Travis
Trinidad	Henderson
Twin Buttes	Tom Green
White River	Crosby
Whitney	Bosque, Hill
Wright Patman (Texarkana)	Bowie, Cass


LAKE TRAVIS

LAKE TRAVIS

STORET NO. 4836

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Lake Travis is mesotrophic; i.e. moderately supplied with nutrients and moderately productive. Whether nutrient enrichment is beneficial or deleterious depends on the actual or potential effect on the uses of the lake. In this regard, no nuisance conditions are known to personnel of the Texas Water Quality Board and there is little or no impairment of the designated beneficial uses of this water body.

Lake Travis ranked tenth in overall trophic quality when the 39 Texas reservoirs sampled in 1974 were compared using a combination of six water quality parameters[a]. However, the lower ranking of this lake is due to a relatively high median inorganic nitrogen concentration (but the lake is phosphorus limited) and depletion of hypolimnetic dissolved oxygen.

Four of the reservoirs had less and one had the same median total phosphorus, two had less and five had the same median dissolved orthophosphorus, seven had less mean chlorophyll a, 29 had less and two had the same median inorganic nitrogen, and three had greater mean Secchi disc transparency. Marked depression or depletion of hypolimnetic dissolved oxygen

[a] See Appendix A.

occurred at all sampling stations in August; at stations 1, 3, 4, and 6 in May; and at station 7 in November.

Survey limnologists noted small patches of submerged macrophytes in the shallows near station 1 in May, station 2 in March, and station 3 in August.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Lake Travis was limited by phosphorus at the times the samples were collected (03/14-15/74 and 11/06/74). The lake data indicate phosphorus limitation at all sampling stations and times except station 5 in November.

C. Nutrient Controllability:

1. Point sources--During the sampling year, point sources contributed 4.7% of the total phosphorus input to Lake Travis. The municipal wastewater treatment facility at Marble Falls contributed 2.9%; and the facility at Johnson City contributed 1.8% of the total.

The present phosphorus loading is less than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 16). However, because the lake is phosphorus limited, point-source phosphorus control would be a preventative measure to maintain the present quality of the lake.

2. Non-point sources--The Colorado River contributed the largest phosphorus load of the sampled tributaries (80.1%). However, much of this load can be attributed to point sources

upriver. Considering only the phosphorus contributions of point sources impacting upstream Lake Lyndon B. Johnson[4] and the phosphorus retention in that lake during the sampling year (3%), it is calculated that 16,405 kg of the upstream point-source phosphorus load also impacted Lake Travis (i.e., 97% of the 16,910 kg point-source load impacting Lake Lyndon B. Johnson).

The other gaged tributaries to Lake Travis contributed 9.6% of the phosphorus load. Ungaged tributaries and immediate drainage were estimated to have contributed 2.9% of the total.

[4] Working Paper No. 645

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS[1]

A. Morphometry[11]:

1. Surface area: 76.61 kilometers^2.

2. Mean depth: 18.9 meters.

3. Maximum depth: 58.5 meters.

4. Volume: 1,447,929 x 10^6 m^3.

5. Mean hydraulic retention time: 1 year (based on outflow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Colorado River	94,081.7	36.14
Cow Creek	110.6	0.34
Pedernales River	3,071.7	7.46
Minor tributaries & immediate drainage -	1,416.0	4.49
Totals	98,680.0	48.43

2. Outlet -

Colorado River	98,756.6**	45.02

C. Precipitation***:

1. Year of sampling: 92.0 centimeters.

2. Mean annual: 82.5 centimeters.

[1] Table of metric conversions--Appendix B.
[11] Butler, 1974.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Travis Lake was sampled four times in 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two or more depths at five stations in March and six stations in May, August, and November (see map, page vi). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first and last visits, two 18.9-liter depth-integrated samples were composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 53.6 meters at station 1, 35.1 meters at station 2, 33.9 meters at station 3, 26.5 meters at station 4, 9.8 meters at station 5, and 18.6 meters at station 6.

The sampling results are presented in full in Appendix D and are summarized in the following table (the August nutrient samples were not properly preserved and were not analyzed).

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[illegible]	[illegible]	[illegible]	[illegible]

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
03/14-15/74	1. Cryptomonas sp.	407
	2. Chroomonas sp.	244
	3. Chlamydomonas sp.	41
	4. Oocystis sp.	41
	5. Scenedesmus sp.	41
	Other genera	39
	total	893
05/22/74	1. Coelastrum sp.	518
	2. Fragilaria sp.	518
	3. Chroomonas sp.	330
	4. Cryptomonas sp.	100
	5. Tetraedron sp.	141
	Other genera	236
	total	1,931
08/20/74	1. Synedra sp.	854
	2. Cyanophytan filaments	256
	3. Melosira sp.	171
	4. Tetraedron sp.	57
	5. Chlorophytan coccoid cells	57
	Other genera	75
	total	1,279
11/06/74	1. Cyclotella sp.	103
	2. Chlamydomonas sp.	69
	3. Cryptomonas sp.	69
	4. Scenedesmus sp.	68
	5. Oocystis sp.	34
	Other genera	70
	total	413

f. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (mg/l)
03/14-15/74	1	1.1
	2	3.2
	3	1.6
	4	1.6
	5	-
	6	6.6
05/22/74	1	6.6
	2	6.8
	3	6.6
	4	9.7
	5	12.4
	6	10.4
08/20/74	1	2.0
	2	1.4
	3	2.5
	4	4.9
	5	23.9
	6	7.5
11/06/74	1	1.9
	2	1.5
	3	1.7
	4	1.8
	5	-
	6	1.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. March sample -

(1). Stations 1 and 2.

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	<0.005	0.260	0.1
0.050 P	<0.055	0.260	4.9
0.050 P + 1.0 N	<0.055	1.260	9.9
1.0 N	<0.005	1.260	0.1

(2). Stations 4 and 4.

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	<0.005	0.383	0.1
0.050 P	<0.005	0.383	5.1
0.050 P + 1.0 N	<0.005	1.383	9.0
1.0 N	<0.005	1.383	0.1

b. November sample -

(1). Stations 1, 2, and 3.

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.007	0.212	0.2
0.050 P	0.057	0.212	4.8
0.050 P + 1.0 N	0.057	1.212	17.4
1.0 N	0.007	1.212	0.3

(2). Stations 4, 5, and 6.

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.011	0.236	0.9
0.050 P	0.061	0.236	5.6
0.050 P + 1.0 N	0.061	1.236	17.8
1.0 N	0.011	1.236	0.8

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of lake Travis was low to moderate at the times the samples were collected (03/14-15/74 and 11/06/74). Also, an increase in yields with the addition of orthophosphorus alone indicates that the lake was phosphorus limited at those times.

Note that the addition of nitrogen alone resulted in yields which were not significantly different from those of the controls.

The lake data indicate phosphorus limitation as well. At all sampling stations and times, the mean inorganic nitrogen/orthophosphorus ratios were 15/1 or greater, except for station 5 in November where the ratio was 13/1 (possible nitrogen limitation).

IV. NUTRIENT LOADINGS
(See Appendix I for data)

For the determination of nutrient loadings, the Texas National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the months of April and May when two samples were collected. Sampling was begun in September, 1974, and was completed in August, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Texas District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads at station C-1, in kg/km^2/year, and multiplying by the ZZ area in km^2.

The operator of the Burnet wastewater treatment plant provided monthly effluent samples and corresponding flow data; however, the plant does not discharge wastewater to Travis Lake (Wyatt, 1976) and is not included in the loadings. The operators of the treatment plants at Johnson City and Marble Falls did not participate; nutrient loads from these sources were estimated at 1.134 kg P and 3.401 kg N/capita/year, and flows were estimated at 0.3785 m^3/capita/day.

* See Working Paper No. 175.

A. Waste Sources:

1. Known domestic -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Burnet*	3,000	cont. stab	-	no discharge**
Johnson City†	800	stab. pond	302.8	Pedernales River
Marble Falls*	1,250	tr. filter	473.1	Colorado River

2. Known industrial - None

* Treatment plant questionnaire.
** Wyatt, 1976.
† Anonymous, 1971.

B. Annual total Phosphorus loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Colorado River	39,585	80.1
Cow Creek	145	0.3
Pedernales River	4,575	9.3
b. Minor tributaries & immediate drainage (non-point load) -	1,415	2.9
c. Known domestic STP's -		
Johnson City	905	1.8
Marble Falls	1,420	2.9
d. Septic tanks* -	15	<0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	1,340	2.7
total	49,400	100.0

2. Outputs -

Lake outlet - Colorado River 27,165

3. Net annual P accumulation - 22,235 kg.

* Estimate based on 60 lakeshore dwellings (elevation 691 to shoreline; Wyatt, 1976); see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Colorado River	1,366,785	70.7
Cow Creek	14,040	0.7
Pedernales River	282,180	14.6
b. Minor tributaries & immediate drainage (non-point load) -	179,830	9.3
c. Known domestic STP's -		
Johnson City	2,720	0.2
Marble Falls	4,250	0.2
d. Septic tanks* -	640	<0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	82,710	4.3
Total	1,933,136	100.0

2. Outputs -

Lake outlet - Colorado River	1,121,110

3. Net annual N accumulation - 812,025 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Colorado River	<1	15
Cow Creek	1	127
Pedernales River	1	92

* Estimate based on 60 lakeshore dwellings (elevation 691 to shoreline; Wyatt, 1976); see Working Paper No. 175.
** See Working Paper No. 175.

f. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Doe River	0.011	0.637
Alligator Creek	0.920	1.097
Double Horn Creek	0.018	0.690
Flat Creek	0.010	0.590

f. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m²/yr	0.64	0.29	25.2	10.6

Vollenweider phosphorus loadings (g/m²/yr) based on mean depth and mean hydraulic retention time of Lake Travis:

"Dangerous" (eutrophic loading)	0.84
"Permissible" (oligotrophic loading)	0.42

V. LITERATURE REVIEWED

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Wyatt, Linda B., 1976. Personal communication (point sources impacting Lake Travis). TX Water Qual. Bd., Austin.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKING

LAKE CODE	LAKE NAME	[illegible] TOTAL *	[illegible] INDEX *	[illegible] SEC	[illegible] CAPACITY	[illegible]	[illegible] INDEX INDEX *
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[illegible]	PALESTINE LAKE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] [illegible] RESERVOIR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	SAN ANGELO RESERVOIR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	SAN [illegible] RESERVOIR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
79	E = SPRING RESERVOIR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

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[illegible] OF LAKES WITH HIGHER VALUES; NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	[illegible] TOTAL P	[illegible] INORG N	[illegible] MEAN CHL	[illegible] CHLOPH	[illegible] SECCHI	[illegible] SIOS [illegible]	[illegible] TSI
[illegible]	[illegible] LAKE	24 (11)	55 (25)	24 (11)	3 (1)	67 (25)	38 (18)	[illegible]
[illegible]	[illegible] LAKE	16 (7)	47 (17)	5 (2)	16 (7)	62 (33)	39 (14)	254
[illegible]	[illegible] [illegible]	44 (15)	37 (14)	67 (33)	42 (16)	17 (6)	54 (19)	372
[illegible]	[illegible] LAKE	32 (12)	78 (29)	37 (14)	21 (8)	63 (24)	35 (13)	214
[illegible]	[illegible] LAKE	11 (4)	51 (19)	11 (5)	16 (5)	72 (27)	11 (5)	176
[illegible]	[illegible] LAKE	34 (14)	34 (13)	61 (23)	46 (17)	17 (6)	21 (7)	217
[illegible]	[illegible] LAKE	60 (23)	21 (7)	42 (25)	62 (32)	17 (2)	44 (32)	284
[illegible]	[illegible]	5 (0)	61 (22)	11 (4)	5 (2)	42 (25)	8 (0)	169
[illegible]	[illegible] [illegible]	59 (22)	42 (7)	56 (22)	61 (22)	44 (17)	63 (23)	311
[illegible]	[illegible] [illegible]	84 (32)	61 (22)	76 (29)	65 (34)	17 (6)	63 (23)	346
[illegible]	[illegible] LAKE	63 (24)	51 (14)	76 (32)	71 (27)	17 (6)	76 (28)	357

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

[illegible] FLOW INFORMATION FOR [illegible]

LAKE CODE =15 THIRTY LAKE

TOTAL DRAINAGE AREA OF LAKE(S) =[illegible] SQ.MI.

SUB-DRAINAGE AREA NO.	AREA SQ MI	JAN	FEB	MAR	APR	MAY	ACCUMULATED FLOWS (CFS) JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
[illegible]	[illegible]	21.07	21.22	34.47	45.83	45.32	34.46	26.71	20.29	19.48	18.47	19.21	19.85	25.12
[illegible]	9.88	18.11	21.24	34.19	35.28	42.41	32.29	24.84	19.49	17.18	17.25	17.73	17.98	28.14
[illegible]	[illegible]	5.31	5.34	5.71	5.47	5.17	5.62	5.46	5.24	5.13	5.41	5.08	5.41	5.34
[illegible]	9.7	5.35	5.54	5.45	5.41	11.14	5.48	5.42	5.18	12.13	10.25	5.74	5.41	7.45
[illegible]	[illegible]	2.41	3.47	3.19	5.25	5.21	5.21	5.09	4.28	5.41	5.13	2.45	2.69	4.49

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = [illegible]
SUM OF SUB-DRAINAGE AREAS = [illegible]

TOTAL FLOW IN = 574.49
TOTAL FLOW OUT = 539.44

[illegible] FLOWS AND ADJ.T FLOWS(CFS)

THIRTY/THIRTY	[illegible]	[illegible]	[illegible] FLOW	[illegible]	FLOW	DAY	FLOW	DAY	FLOW
[illegible]	0	34	102,791	7	97,449				
	23	34	124,829	5	0.0				
	17	34	144,511	2	185,311				
	12	34	59,485	7	85,982				
	1	35	75,829	4	85,982				
	2	35	145,431	23	174,264				
	3	35	85,137	1	159,342				
	4	35	98,714	2	95,441	19	71,928		
	5	35	244,357	4	154,044	24	154,844		
	6	35	207,824	7	154,744				
	7	35	84,384	24	84,043				
	8	35	42,242	29	58,471				
[illegible]	9	34	85,248	6	24,443				
	10	34	34,122	9	0.0				
	11	34	124,374	6	0.0				
	12	34	31,244	7	0.0				
	1	35	44,271	6	24,877				
	2	35	102,873	6	139,411				
	3	35	35,113	6	58,462				
	4	35	52,987	2	34,747	19	34,744		
	5	35	145,442	23	174,171	24	144,744		
	6	35	74,284	24	61,477				
	7	35	24,444	7	144,744				
	8	35	35,473	24	34,243				

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APPENDIX D

PHYSICAL and CHEMICAL DATA

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DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]				
TO	[illegible]	FEET	[illegible]	[illegible]	[illegible]
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	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]			[illegible]
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]			[illegible]
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]		

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DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	24 15 0000	[illegible]	[illegible]	[illegible]	
	24 15 0010	[illegible]			
	24 15 0030	[illegible]			
	24 15 0040	[illegible]			
	24 15 0050	[illegible]			
	24 15 0125	[illegible]			
[illegible]	11 10 0006	[illegible]	[illegible]		
	11 10 0605	[illegible]			
	11 10 0630	[illegible]			
	11 10 0645	[illegible]			
	11 10 0650	[illegible]			
	11 10 0100	[illegible]			
	11 10 0130	[illegible]			
[illegible]	15 35 0000		[illegible]		
[illegible]	10 45 0000	[illegible]	[illegible]		
	10 45 0001				
	10 45 0005	[illegible]			
	10 45 0025	[illegible]			
	10 45 0040	[illegible]			
	10 45 0055	[illegible]			
	10 45 0100	[illegible]			
	10 45 0130	[illegible]			

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APPENDIX I

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

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DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TO	DAY	FEET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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